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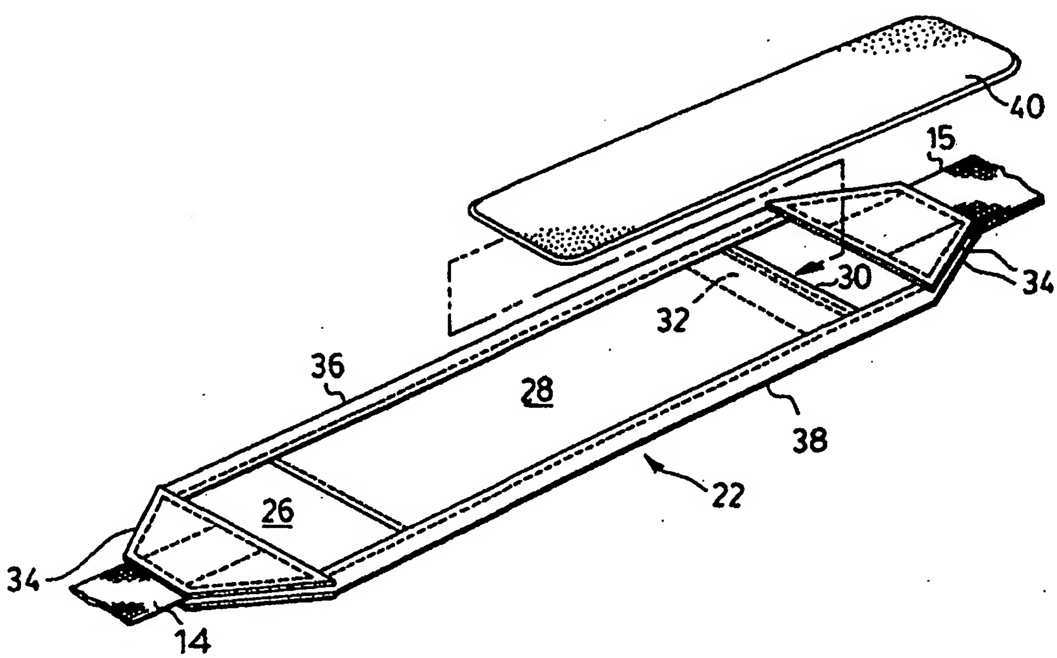


(57) Abstract

A shoulder strap (10) has a bladder (40) of a composite mixture for distributing a tensile load over a contact area. The shoulder strap (10) has an area for contacting a shoulder of a user. The contact area is intermediate ends of the strap. The load is applied to the ends of the strap, transferred through the bladder (40) to the contact area.

SHOULDER STRAP FOR A BAG

Field of Invention

This invention relates to a shoulder strap for a bag. In particular, this invention relates to a shoulder strap having improved pressure distribution capabilities.

Background of Invention

The shoulder strap has been used to carry many different bags. In general, the shoulder straps of the prior art have been designed to try to reduce the pressure on the biological tissues of the shoulder and hence reduce discomfort and injury to the shoulder.

The weight of the bag is distributed over an area on the shoulder where the shoulder strap is in contact with the shoulder. If the shoulder strap was extended over a smooth uniform surface, then there would be even distribution of pressure over the entire area. However, the shoulder is an uneven surface which means that the actual pressures generated will be significantly different. There will be concentrations of pressures in and around the uneven area.

The shoulder is a complex structure made up of bone, muscle, vessels, nerves and skin. The shoulder girdle is comprised of the scapula on the back, clavicle on the front and the humerus to the side. The scapula has a lot of ridges because it has a

spine which is basically a bony ridge. On the front portion of the scapula there are points which are bony prominences called the acromion, and coracoid process.

The scapula is attached to the clavicle which is a strut that holds the shoulder joint away from the breast bone and it to is a long bony ridge. All of these bony prominences would create pressures as discussed above.

The humerus is the final bone which completes the shoulder girdle and although it is not subjected to the pressures of the strap, the muscles that are attached to the humerus are and hence it is included here for later reference.

The shoulder girdle has a total of 8 muscles but the three most significant for the strap issue are of the trapezius, supraspinatus, and deltoid muscles.

The trapezius muscle is the largest and extends from the cervical spine across the top of the shoulder and scapula. It creates the sloping contour of the shoulder. The supraspinatus muscle runs across the top of the shoulder and inserts into the greater tuberosity of the humerus bone. The deltoid muscle covers the lateral aspect of the shoulder as well.

The skin over the shoulder area is quite diverse. The skin may be lying over a large cushy muscle area such as over the trapezius muscle while in other areas, it is overlying bony structures such as the clavicle.

External pressure can inflict injury to biological tissues by direct and indirect mechanisms:

1)	Direct Injury	Direct Pressure Shear Forces
2)	Indirect Injury	Reduced Blood Flow

The direct mechanisms cause direct damage to the tissues. This can come from direct pressure and shear forces. Both these processes can cause micro and macroscopic tissue injury. Direct pressure can cause damage by physically disrupting cellular integrity. This is much like the breaking of those "bubble pack" used in shipping merchandise, the pressure causes damage to the membrane and the "cellular bubble" ruptures. This can occur with living tissues such as skin, and muscles nd tendons.

For the shoulder, the skin and muscles are the most vulnerable and the higher the pressures applied to them, the more likely they will be damaged or impaired. This also implies that a reduction in pressures would be of benefit to these tissues.

The second direct force to inflict injury to the tissues are the shearing forces. These are lateral forces generated when one object is sliding over another. As the tissues slide over each other, they disrupt the cells and their intercellular connections.

The shoulder has a natural slope due to the shape of the trapezius muscle. A conventional foam strap tends to slide off this slope because it has a limited ability to

conform to the contours of the shoulder. This creates shear forces across the skin and muscles and hence injures the tissues.

The indirect injures are more subtle and involve blood flow and metabolism issues.

All biological tissues require blood circulation in order to bring in nutrition and substrates for chemical reactions to provide energy for the tissues. This circulation consists of a high pressure arterial side, and a low pressure return flow venous side and a capillary system in between to allow for the orderly exchange of nutrients and waste removal. Each component has different average pressures associated with it and hence each will be affected differently by an external compression forces. Theoretically, the capillary system would be most easily blocked by external compression, then the venous system and finally, at much higher pressures, the arterial system.

Assuming that only the low pressure systems are affected, this would still impair the delivery of substrates required for metabolism. If the venous and capillary systems were compressed, the back up would affect the whole system. There would be less flow into the system and the tissues may swell as the outflow remains comprised. This reduced blood flow would cause many metabolic problems.

For example, with less blood flow then there is less oxygen being delivered. The muscles require oxygen for aerobic metabolism whereby oxygen is used to burn the substrates. If there is not enough oxygen then anaerobic metabolism must take over and because anaerobic combustion is not as efficient, more waste materials would build up. These waste materials, which include lactic acid, causes fatigue and also the burning sensation that most runners and athletes experience.

If the compression pressure was high enough to impair arterial flow then the lack of any nutrients flowing into the tissues would dramatically injure the tissues and this would greatly reduce the muscle function. So blockage of this system results in even worse performance than the simple blockage of the low pressure systems. This indirect injury is worse with increasing duration. So the longer the walk to the next golf hole, the more injury to the muscles.

The bony structures are relatively protected as their blood systems are inside the hard bony shell. The skin and muscles on the other hand are exposed to both the direct and indirect damaging forces.

The skin is very vulnerable to pressure. This is evidenced by the mark that is left after pressure has been applied to an area on the skin. The external force compresses the capillary system and forces blood out of the system and hence there is blanching in the area. With the release of pressure, the blood begins to reflow back into the system. The build up of waste materials has a potent vasodilatory effect

which was designed to help flush out the high concentrations of waste materials. Hence there is usually a post pressure redness indicating the inflow of extra blood. This additional inflow may even cause swelling of the tissues. All straps with higher pressures will have this effect more exaggerated.

The muscles are being exposed to the same set of pressures. Again there is compromise of blood flow and hence build up of waste materials and also some swelling. The removal of pressure causes an influx of blood and again the vasodilatory effects is evident. Again this may lead to swelling of the muscles.

Each time there is compression and compromise of the circulation leading to waste build up and then vasodilation and reperfusion and swelling. This series of events will cause the muscle to be fatigued and force it to have inconsistent performance.

A particular bag which is carried on the shoulder with a shoulder strap and which can cause a lot of strain on a person's shoulder is a golf bag. The average golf bag with a standard club compliment weighs about 25 pounds.

Golfers are constantly focusing on improving their driving distance and scores. Golfers buy the best clubs to help improve their performance and the best golf balls with the best range and control. Yet amazingly, golfers rarely pay homage to the muscles and tissues which are the engines for their golf swing. The same muscles in

the bladder that are compromised from carrying a golf bag arr also the ones required to control the shoulder in the standard golf swing. Further, there are eight muscles involved in the shoulder girdle and three, the trapezius, supraspinatus, deltoid muscles, are not at full function and hence there is an imbalance which will cause the shoulder not to function as well or as consistently as it should. Many times, these muscles have to work as the pack mules for the golfer and then are expected to turn on a dime and swing into action to produce the perfect golf swing despite the injuries and strains.

As in so many systems, the break down is in the weakest link. For many golfers who carry bags, the clubs, balls etc. may be the best, but the muscles are overworked and overlooked. They are exposed to great pressures and ischemia. This results in inconsistent and suboptimal performance of the muscle and hence the golf swing.

In general, shoulder strap designs have focussed on: using more foam to increase the padding in the shoulder strap; molding the foam into specific shapes and configurations to improve the straps conformation around the surface, particularly into compartments such as muliple pockets/bubbles; and wrapping cushioning devices around the straps to increase padding. These prior art designs have been inadequate in minimizing the pressure placed on the shoulder using such shoulder straps.

The standard foam shoulder strap of the prior art conforms to the shape of the shoulder. The foam is vertically compressed at the point region. The regions around it are not compressed and hence are not sharing in the same load bearing. This translates into a concentration of pressure over a very small area. Hence the bulk of the weight would be centred on a small area as opposed to distributing it evenly over the contact area where the shoulder strap meets the shoulder. With the reduced surface area, the peak pressure rises.

Foam shoulder straps have also been compartmentalized into bubbles, strips or multiple pockets. These compartmentalized shoulder straps are designed to protect the shoulder much like the way a bubble pack protects products in transit. However, these shoulder straps are limited in their ability to redistribute the pressure/load distribution because of their imperfect contouring and reduced area of contact.

Further shoulder straps of the prior art include wrapping the shoulder strap with padding to increase the padding around the strap in an attempt to reduce the pressure on the shoulder. These wrap devices are inadequate for minimizing the pressure on the shoulder because they localize the pressure points on the shoulder.

Summary of Invention

The disadvantages of the prior art may be overcome by providing a shoulder strap for a bag which minimizes the pressures on the shoulder muscles.

It is desirable to provide a shoulder strap for a bag which reduces the pressures on the shoulder tissues to minimize injury and hence maintain the proper function of the shoulder muscle tissues.

According to one aspect of the invention, there is provided a shoulder strap for a bag having a bladder of a composite mixture for evenly distributing a load over a support area intermediate ends of the strap when the load is applied to the ends of the strap.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the bladder is enveloped within the strap at a support area.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the strap has a pocket for receiving a bladder of a composite mixture for evenly distributing a load over a support area which is intermediate to the ends of the strap when the load is applied to the ends of the strap.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the strap has a pocket with a fastener for releasably opening and closing the pocket for selectively removing and replacing a bladder of a composite mixture for evenly distributing a load over a support area intermediate ends of the strap when the load is applied to the ends of the strap.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the shoulder strap has a bladder of a composite mixture comprising liquids or molecular dispersions having a viscosity of greater than 900 centipoise (cP).

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the shoulder strap has a bladder of a composite mixture comprising coarse dispersions.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the shoulder strap has a bladder of a composite mixture comprising colloidal dispersions selected from one or more of the following group of mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid, macromolecules/ solvent; and micelles/solvent.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the shoulder strap has a bladder of a composite mixture comprising a mixture of a molecular and colloidal dispersion wherein the viscosity of the mixture is greater than 900 cP or the colloidal dispersion is selected from one or more of the following group of mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid, macromolecules/ solvent; and micelles/solvent.

According to another aspect of the invention, there is provided a shoulder strap for a bag wherein the shoulder strap has a bladder of a composite mixture comprising a mixture of coarse and molecular dispersions, coarse and colloidal dispersions, or coarse, colloidal and molecular dispersions.

According to another aspect of the invention, there is provide a shoulder strap for a bag comprising: a pad comprising a bladder of a composite mixture wherein the bladder is contained within a pocket, a first strap and a second strap attached at opposite ends of the pad, and a flexible inelastic bladder having a composite mixture retained in the pocket.

According to another aspect of the invention, there is provided a shoulder strap for a bag comprising: a pad comprising a composite mixture and constraining means for constraining a composite mixture, a first strap and a second strap attached at opposite ends of the pad, and a volume of the composite mixture within the means. The volume is sufficient for transferring tensile loads applied to opposite ends of the first and second straps through the means to distribute the loads substantially evenly over a contact area between the shoulder strap and a shoulder of human anatomy.

According to another aspect of the invention a shoulder strap for a bag is provided wherein the shoulder strap has a pad having a pocket and a bladder wherein said bladder comprises a composite mixture in a volume sufficient for transferring

tensile loads across substantially the entire area in which the pad contacts the shoulder and said composite mixture comprises Floam™.

Description of the Drawings

In drawings which illustrate the preferred embodiments of the invention,

Figure 1	is a perspective view of a golfer carrying a golf bag incorporating a shoulder strap of a first embodiment of the present invention;
Figure 2	is a partial perspective view of the shoulder strap of Figure 1;
Figure 3	is a partial exploded perspective view of the underside of the shoulder strap of Figure 1;
Figure 4	is a transverse cross sectional view of the shoulder strap of Figure 1 along the lines 4-4 in Figure 2;
Figure 5	is a longitudinal cross sectional view of the bladder of Figure 1;
Figure 6A	is a schematic representation of the testing of a shoulder strap on an individual to determine the pressures exerted on that individual by the shoulder strap and bag using a sensory array and computer to record the pressure spots;
Figure 6B	is a schematic representation and computer display of pressure areas measured on a shoulder using the sensory array and computer of Figure 6A using a shoulder strap of the prior art;

Figure 7 is a schematic representation and computer display of pressure areas measured on a shoulder using the sensory array and computer of Figure 6A using a shoulder strap of Figure 1 with a rectangular shaped bladder;

Figure 8 is a schematic representation and computer display of pressure areas measured on a shoulder using the sensory array and computer of Figure 6A using a shoulder strap of Figure 1 with a circular shaped bladder;

Figure 9 is an exploded view of a second embodiment of the shoulder strap of the present invention;

Figure 10 is a transverse sectional view of the shoulder strap of Figure 9.

Description of the Invention

Referring to Figure 1, the shoulder strap 10 of the present invention is illustrated carrying a golf bag 12 having a full compliment of golf clubs 16. The shoulder strap 10 has a security hook 18 at each end thereof for releasably attaching the strap at opposite end regions of the golf bag. Shoulder strap 10 has a buckle 20 at each end thereof for adjusting the length of the shoulder strap.

The shoulder strap 10 has a main straps 14 and 15. Main straps 14 and 15 are preferably made of a NYLON or other high strength flexible material. Intermediate the ends of main strap 14 and 15 is a pad 22. The pad 22 is located for contact with a shoulder of a user such that the shoulder strap 10 carries a load such as a golf bag

which is transferred to the user over contact area 42. The pad 22 has a width greater than the width of the straps 14 and 15.

Referring to Figures 2, 3 and 4, the reinforced pad 22 of the present invention is described in greater detail. The pad 22 has an inner layer 26. Attached to the inner layer 26 a pocket formed by pocket layer 28. Pocket layer 28 is preferably rectangular in shape and sewn to inner layer 26 along three edges leaving edge 30 open presenting a pocket there between.

Straps 14 and 15 are attached to ends of the pad 22 by reinforcement pads 34. Reinforcement pads 34 are preferably sewn to the straps 14 and 15 and the pad 22. The reinforcement pads 34 are sewn along the total width of the pad 22 at either end thereof which ensures that when the bag 12 is slung onto the shoulder, tension is created between the pad 22 and the straps 14 and 16 at either end of the pad 22 along the entire width of the pad 22. It is this tension which pulls the pad 22 down against the shoulder and therefore the area of the pad 22 which is between the attachments of the pad 22 to the reinforcement pads 34 distributes the weight of the bag 12 over the shoulder. If the straps 14 and 16 are attached to the pad 22 along less than its total width, then the entire pad 22 is not used to contact with the shoulder. This would result in higher pressure over the contact area 42 of the shoulder with the results being greater discomfort and possible tissue injury.

Inner layer 26, pocket layer 28, and reinforcement pads 34 are preferably sewn together along edge strips 36 and 38. Edge strips 36 and 38 cover the outer edges of pad 22 to integrate the pad 22 to the straps 14 and 15 and improve the aesthetics of the shoulder strap 10 of the present invention.

The pocket has a fastener 32 for closing or releasably securing edge 30 to inner layer 26. In the preferred embodiment, the fastener is a hook and loop type fastener 32. One portion of either the hook and loop fastener is attached to the outer face of inner layer 26, while the other complementary portion is attached to the inner face of pocket layer 28.

It is readily understood that other fasteners could be used instead of the hook and loop fastener. Such fasteners include zippers, buttons and dome fasteners. Further, a fastener could easily be replaced by sewing the bladder within the pocket.

Bladder 40 is inserted into the pocket between pocket layer 28 and inner layer 26. Bladder 40 has an upper wall 43 and a lower wall 42 and is made of a flexible yet inelastic material which is sealed along the outer edges to retain a composite mixture therein. Bladder 40 is filled with a composite mixture. Bladder 40 must have a sufficient volume of the composite mixture to effectively transfer tensile loads applied to opposite ends of straps 14 and 15 through the bladder 40 over a contact area 42 on a shoulder.

The composite mixture in the bladder 40 should be filled to a minimum quantity such that any deformation of the straps 14 and 16 that would be expected when it is placed upon the shoulder of an individual does not cause the two walls 41 and 43 of the bladder to touch except where the walls 41 and 43 of the bladder 40 are attached together. If the bladder 40 were not filled to sufficient quantity with composite mixture, the deformation of the straps 14 and 16 around the shoulder would cause the bladder walls 41 and 43 to contact thereby leaving an area of the shoulder unprotected by the composite material. This would result in increased pressure over that unprotected area with the resultant disadvantage of discomfort and possible tissue injury.

On the other hand, the bladder 40 should not be filled with an excess quantity of composite mixture such that the bladder walls 41 and 43 are under tension in the resting position i.e. resting tension. There are three possible consequences of this resting tension. The pad 22 , with such tension, is at its lowest energy state when it is perfectly straight and therefore resists any deformation. As the straps 14 and 16 are curved around the shoulder, tension is further increased along the upper wall 43 as it is pulled around the lower wall 41 and this tension works to pull the pad 22 back straight again. This results in portions of the pad 22 being pulled off the shoulder with the result that conformity to the shoulder is achieved only at the center regions of the pad 22. This results in a decreased contact area 42 and increased pressures over the contact area 42 with the resultant disadvantages of discomfort and possible injury.

The second possible consequence of resting tension occurs when the bladder 40 is deformed by a protuberance. Since the walls 41 and 43 are under tension, they resist the deformation caused by the protuberance increasing the tension on the walls 41 and 43. This resistance to deformation causes a force to be exerted back onto the protuberance, also known as a head pressure, increasing the discomfort and possible injury to the shoulder.

The third possible consequence of a bladder with resting tension is decreased conformity of the lower wall to the shoulder. As the bladder is curved around the shoulder, the upper wall becomes stretched while the lower wall forms redundant folds as it is compressed to a smaller length compared to its resting position. If the bladder had resting tension, the act of curving the bladder around the shoulder would produce greater tension in the upper wall and hence the upper wall would seek to straighten itself out in order to lower the tension. To do this it would exert a force upward at the edges of the bladder and downward over the center of the bladder. This force downward would push fluid into the redundant folds of the lower wall of the bladder. This decreases the contact area 42 of the pad 22 to the shoulder as the folds are not in good contact with the shoulder. Hence, at the folds, greater pressures are exerted onto the shoulder as compared with a pad with uniform contact. These areas of greater pressure can cause discomfort and tissue injury.

Generally, a mixture describes a product in which there are at least two substances which remain to some extent separated from each other such that some of

their own properties are retained. In this application, the term composite mixtures includes liquids of a viscosity higher than about 900 cP and mixtures.

In a preferred embodiment, the mixture is a product in which one or more substances are dispersed in a dispersion medium. The substance in a mixture that is dispersed is known as the disperse phase or dispersion phase. The size of the particles of the disperse phase give rise to the classification listed below. The following outlines approximate size limits of the disperse phase particles for each class.

Molecular dispersion	(Solution)	< 1 nm
Colloidal dispersion	(Colloids)	1 nm - 1000 nm
Coarse dispersion	(Mechanical suspension)	> 1000 nm

The following substances could be used in the composite mixture for the bladder 40 for the shoulder strap of the present invention:

liquids with a viscosity greater than 900 centipoise;

molecular dispersions with a viscosity greater than 900 centipoise;

coarse dispersions;

colloidal dispersions selected from one or more of the following group of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid, macromolecules/ solvent; and micelles/solvent.;

molecular and colloidal dispersions wherein the viscosity of the mixture is greater than 900 cP or the colloidal dispersion is selected from one or more of

the following group of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid, macromolecules/ solvent; and micelles/solvent;

molecular and coarse dispersions;

colloidal and coarse dispersions; and

molecular and colloidal and coarse dispersions.

A preferred composite mixture is a coarse dispersion containing lightly lubricated micro-sphere material available under the trade-mark FLOAM and more fully described in United States Patent No. 5,549,743, incorporated herein by reference. The composite mixture has the ability to spread when compressed.

In a preferred embodiment of the invention, the composite mixture is light weight and comprises a dispersion phase and a dispersion medium. Preferably, the dispersion phase comprises microspheres containing air which are dispersed in a sufficient amount of the dispersion medium so that the microspheres undergo a rolling/sliding mechanism when pressure is applied to the mixture. This mechanism displaces the mixture. Additionally, the composite mixture has minimal memory once displaced so that it does not readily return to its former state prior to being displaced. The composite material should be able to flow around the contour of the player's shoulder thereby enabling better distribution of pressure.

For the purposes of filling the bladder 40 of the present invention, a liquid of relatively high viscosity may be utilized as the composite mixture. Generally a

contained liquid when pushed upon in one spot tries to return to its original position due to the effects of gravity which tries to level the liquid layer. This tendency to level off results in a pressure head developing on the object pushing on the contained liquid. This would result in high pressure areas over the various prominences of the shoulder and inevitable discomfort. The high viscosity or internal friction opposes deforming forces and therefore would oppose the formation of the pressure head. This would lead to a more even distribution of pressure and greater comfort.

Two examples of high viscosity liquids that could be used to fill the bladder are stated along with their viscosities.

	Temp (°C)	n (cP)
Glycerin	20	1490
Castor Oil	20	986

In a preferred embodiment, the composite mixture is a liquid with a viscosity higher than about 900 centipoise.

A molecular dispersion is a mixture which characteristically has a dispersion phase with particles less than 1 nm. The viscosity of a solution suitable for the present invention will include molecular dispersions with viscosity above 900 cP. An example of such a substance comprises about 99% by weight glycerol in water.

Colloidal dispersions refers to mixtures in which the dispersion phase characteristically consists of particles of size between 1 - 1000 nm. Both the

dispersion medium and the dispersion phase may be any of the three states of matter, namely solid, liquid or gas.

Colloidal dispersions may be complex. The following subclasses of colloids of dispersion phase/dispersion mediums may be used: liquid/liquid; solid/liquid; gas/liquid, macromolecules/ solvent; and micelles/solvent. The combination of a disperse phase containing a gas and a dispersion medium containing a solid is not included as a composite mixture for filling the bladder 40 of the shoulder strap of the present invention. This subclass includes the solid foams which are not suitable for the present invention.

The following are examples of possible colloidal dispersions that may be used to fill the bladder 40 of the shoulder strap of the present invention.

Example I: O/W Petrolatum Cream

Ingredients	%w/w
Petrolatum white	35.00
Brij 721, POE 21 stearyl ether	1.00
Brij 72, POE 2 stearyl ether	4.00
Dimethicone	3.00
Water, deionized	56.70
Carbomer 934	0.10
NaOH 10% aqueous sol'n	0.10
Germall II	0.10

Example II: General Purpose Water/Oil Cream

Ingredients	%w/w
A-C Polyethylene 617	2.0
Beeswax	4.0
Mineral Oil	15.0
Arlacel 83	5.5
Propyl-P- Hydroxybenzoate	0.1
Methyl-P-Hydroxybenzoate	0.2
Sorbitol (70%)	5.0
Borax	0.3
Water	67.9

Example III: Clear Gel

Ingredients	%w/w
Mineral Oil, Naphthenic, Drakol 10B	13.70
Brij 97	15.50
Arlatone G	15.50
Propylene glyccol	8.60
Sorbo	6.90
Water, deionized	39.80

Coarse dispersions or mechanical suspensions describes all products which have a disperse phase consisting of particles with dimensions greater than 1000 nm or 1 um. The dispersion medium can consist of any of the following:

pure liquid;

molecular dispersion or solution;

colloid dispersion; and

the disperse phase can consist of any of the following:

particle size greater than 1000 nm in any dimension;

particles of any shape;

particles which may be solid; and

particles which may be hollow with either a gaseous interior or a central vacuum.

A preferred embodiment of a coarse dispersion is as follows:

Dispersion medium

98 % propylene glycol principle molecule
available from Arco Chemical (Newtown Square. Pa.)

2% cationic polyacrilamide cross-linking agent
(or unpolymerized acrylamide)
such as MAGNIFLOC available from Cytec Industries (West Paterson NJ)

to which a preservative such as DANTOGARD which is available from Lonza Corporation (Fair Lawn, NJ) is added in an amount of about 1% of the dispersion medium.

Alternatively, the dispersion medium may be as follows:

Dispersion Medium

99.8% glycerin

0.2% cationic acrilamide cross-linking agent

to which a preservative is added in an amount of about 1% of the dispersion medium.

The disperse phase in the coarse dispersion has the following characteristics:

spherical objects (microspheres);

acrylic plastic walled;

10 - 200 um diameter range;

uniform wall thickness and spherical configuration;

specific gravity of about 0.02;

able to withstand 2000 psi of pressure without rupturing; and

having inert gaseous atmospheres sealed there within.

Certain microspheres suitable for a disperse phase have an elastic quality such that they can be compressed to less than 20% of their original volume and can return to about 100% of their original volume when the compressive force is removed. Such microspheres are available under the designation PM 6545 available from PQ Corporation of Pennsylvania

In another embodiment EXPANCEL phenolic microspheres from Expancel of Sweden could be used as the disperse phase.

In the preferred embodiment, the shape of bladder 40 is illustrated as rectangular. However, suitable shapes could include any shape provided a substantial portion of support or contact area 42 is covered. Suitable shapes of bladder include rectangular and circular. The support or contact area 42 is the area where the shoulder strap will contact the shoulder of the user.

In use, the shoulder strap 10 is attached to an article such as a golf bag 12 and clubs 16. As the shoulder strap 10 is presented to the user's shoulder a tensile load is applied to opposite ends of the shoulder strap 10 at security hooks 18. The load is transferred through the strap 10 to a support or contact area 42 overlying the shoulder of the user.

As illustrated in Figure 5, the shoulder strap 10 shows significant advantages with uneven surfaces such as the point contour which presents a pressure point 44. The composite mixture moves away from the high pressure zones into the lower pressure zones around it. Because the material is in a confined space within a bladder 40, the composite mixture accumulates in the lower pressure zone until there is an equalization of the pressure which shifts some of the load onto the lower pressure regions. The shoulder strap 10 basically works by putting more material where the load is the least and it continues to do so until those areas are bearing their proportionate load. This ensures that there is optimal utilization of the surface area and hence the peak pressures generated is reduced. This allows the load to be shared evenly across the whole support or contact area 42.

The shoulder strap 10 is also able to adjust to the contour of the underlying surface and there is no memory involved. So each time that a bag is carried, no matter if the user puts the shoulder strap 10 on differently, there is contouring in all directions in order to have the maximum comfort.

The shoulder strap 10 is able to distribute its load over a larger surface having lower pressures and therefore less potential damage to the soft tissues. The composite mixture redistributes itself to conform to the contour of the shoulder and hence there is a reduction in the slippage and therefore, reduced shear forces. This in turn should lead to less soft tissue injury.

Many types of straps with different materials and shape designs have been tested to illustrate the improved performance of the shoulder strap of the present invention.

The sample straps were divided into categories based on shape, material used for the cushioning insert, and the addition of padded foam on top of the insert or wrapped around the insert. The following were classes of straps tested:

Sample	Insert Material	Description of Shape of Insert or Addition (with/without foam top or wrap)
Sample 1	Foam	Rectangular (Standard Strap)
Sample 2	Foam	Molded Foam
Sample A	Floam™	Wide Circle with foam on top
Sample B	Floam™	Wide Circle without foam on top
Sample C	Floam™	Rectangular with foam on top
Sample D	Floam™	Rectangular

+ Bubble	Floam™	Additional circular Floam™ pack insert
+ H	Floam™	Additional rectangular Floam™ pack wrap with Velcro

Each strap type was tested twice. The testing procedure employed is detailed below.

Referring to Figure 6A, a male subject was used to test all the strap types. The subject was in a standard erect position and a rubberized mat of sensor arrays 200 was placed on the right shoulder of the subject. This sensor arrays 200 was connected to the computer which monitored the pressure readings from the arrays 200. A standard golf bag with the standard complement of golf clubs was then fastened to the straps 214 and 216 that was being tested. This was then placed on top of the sensor array 200 over the subject's right shoulder. Once this was in position, the pressure readings from the sensor array 200 were captured.

Due to the sloping anatomy of the shoulder, the rubber sensor array 200 was designed to cover a larger surface area than the actual strap area. This facilitated the capturing of data for different shapes and sizes of straps and ensured the accuracy of the readings obtained. Also this allowed for some lateral movement of the straps 214 and 216 on the sloping shoulder as it settled into its final position. Only those sensors that were actually activated were included in the calculation of the pressure reads for the study. Hence from strap to strap, there was an expected difference in the number of sensors activated and used for the calculations.

Referring to Figure 6B, 7 and 8, schematic representations and displays of the improved load carrying abilities of the present invention over the prior art are illustrated

in specific examples, namely Samples 1, D and B, respectively. In Figure 6B, representing one of the tests run for Sample 1, the area 46 indicates a high pressure point load which is being experienced by the user of a prior art shoulder strap. In comparison to Figures 7 and 8, representing one of the tests run for Sample D and B, respectively, no such highlighted area is visible indicating the loads are being distributed without significant point loads thereby minimizing injury.

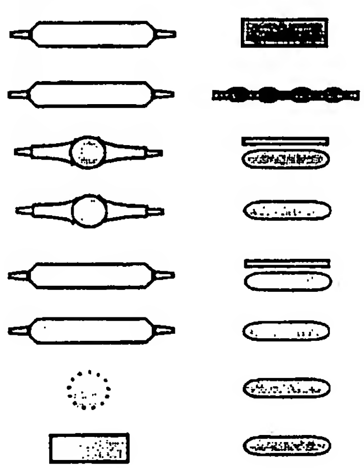
Once the pressure readings were captured, the average pressure and maximum pressures were calculated for each sample and each type of sample.

Table 1A highlights the significant findings of the tests. Table 1B is a legend of the samples tested. Table 2 ranks the tested samples by maximum peak pressures. Table 3 illustrates the average maximum peak pressures and average pressures for both of the samples tested for each strap.

Table 1A Pressure data for straps.

Strap Type	Insert Material Used	Description	Number of Activated Sensors	Variation Coefficient of Activated Sensors	Standard Deviation of Activated Sensors	Average Pressure (mmHg)	Maximum Pressure (mmHg)
Sample 1	Foam	Rectangular	49	69.0	48	69	222
Sample 1	Foam	Rectangular	45	75.9	51	68	245
Sample 2	Foam	Molded Foam	32	77.7	56	73	202
Sample 2	Foam	Molded Foam	36	83.8	50	60	209
Sample A	Floam	Wide, Circle, Foam Top	45	75.7	48	63	178
Sample A	Floam	Wide, Circle, Foam Top	41	72.0	44	61	194
Sample A + H	Floam	Wide, Circle, Foam Top + Rectangular Wrap	32	61.2	47	76	176
Sample A + H	Floam	Wide, Circle, Foam Top + Rectangular Wrap	30	75.7	59	78	238
Sample B	Floam	Wide, Circle	38	75.1	44	59	151
Sample B	Floam	Wide, Circle	42	74.9	48	64	189
Sample B + F	Floam	Wide, Circle + Circle Floam pack insert	30	78.7	53	68	199
Sample B + F	Floam	Wide, Circle + Circle Floam pack insert	35	91.3	57	62	205
Sample C	Floam	Rectangular, Foam Top	45	92.7	51	56	201
Sample C	Floam	Rectangular, Foam Top	32	73.0	53	73	204
Sample C + H	Floam	Rectangular, Foam Top + Rectangular Wrap	26	73.4	62	84	188
Sample C + H	Floam	Rectangular, Foam Top + Rectangular Wrap	25	62.8	57	91	215
Sample D	Floam	Rectangular	29	74.6	47	63	167
Sample D	Floam	Rectangular	34	80.4	48	60	168
Sample D + H	Floam	Rectangular + Rectangular Wrap	37	82.9	53	64	187
Sample D + H	Floam	Rectangular + Rectangular Wrap	24	79.9	57	71	199
Sample D + H	Floam	Rectangular + Rectangular Wrap	26	78.4	65	83	215

Table 1B Legend for Strap Types



Strap	*Shape*	*Cross Section*	*Insert Material*
Sample 1			Foam
Sample 2			Moulded Foam
Sample A			Floam with foam top
Sample B			Floam without foam top
Sample C			Floam with foam top
Sample D			Floam without foam top
+ F			Additional circular Floam pack insert
+ H			Additional rectangular Floam pack wrap (Velcro wrap around)

Table 2 Data ranked in order of increasing Maximum Pressures.

Strap Type	Insert Material Used	Description	Number of Sensors Activated	Variation Coefficient of Activated Sensors	Standard Deviation of Activated Sensors	Average Pressure (mmHg)	Maximum Pressure (mmHg)
Sample B	Floam	Wide, Circle	38	75.1	44	59	151
Sample D	Floam	Rectangular	29	74.6	47	63	167
Sample D	Floam	Rectangular	34	80.4	48	60	168
Sample A+H	Floam	Wide, Circle, Foam Top + Rectangular Wrap	32	61.2	47	76	176
Sample A	Floam	Wide, Circle, Foam Top	45	75.7	48	63	178
Sample D + H	Floam	Rectangular + Rectangular Wrap	37	82.9	53	64	187
Sample C + H	Floam	Rectangular, Foam Top + Rectangular Wrap	26	73.4	62	84	188
Sample B	Floam	Wide, Circle	42	74.9	48	64	189
Sample A	Floam	Wide, Circle, Foam Top	41	72.0	44	61	194
Sample B + F	Floam	Wide, Circle + Circle Floam pack insert	30	78.7	53	68	199
Sample D + H	Floam	Rectangular + Rectangular Wrap	24	79.9	57	71	199
Sample C	Floam	Rectangular, Foam Top	45	92.7	51	56	201
Sample 2	Foam	Molded Foam	32	77.7	56	73	202
Sample C	Floam	Rectangular, Foam Top	32	73.0	53	73	204
Sample B + F	Floam	Wide, Circle + Circle Floam pack insert	35	91.3	57	62	205
Sample 2	Foam	Molded Foam	36	83.8	50	60	209
Sample D + H	Floam	Rectangular + Rectangular Wrap	26	78.4	65	83	215
Sample C + H	Floam	Rectangular, Foam Top + Rectangular Wrap	25	62.8	57	91	215
Sample 1	Foam	Rectangular	49	69.0	48	69	222
Sample A+H	Floam	Wide, Circle, Foam Top + Rectangular Wrap	30	75.7	59	78	238
Sample 1	Foam	Rectangular	45	75.9	51	68	245

Table 3 Average values for each strap type.

Strap Type	Insert Material Used	Description	Average Number of Activated Sensors	Average Variation Coefficient of Activated Sensors	Average Standard Deviation of Activated Sensors	Average Average Pressure (mmHg)	Average Maximum Pressure (mmHg)
Sample 1	Foam	Rectangular	47.0	72.5	49.5	68.5	233.5
Sample 2	Foam	Molded Foam	34.0	80.8	53.0	66.5	205.5
Sample A	Floam	Wide, Circle, Foam Top	43.0	73.9	46.0	62.0	186.0
Sample A + H	Floam	Wide, Circle, Foam Top + Rectangular Wrap	31.0	68.5	53.0	77.0	207.0
Sample B	Floam	Wide, Circle	40.0	75.0	46.0	61.5	170.0
Sample B + F	Floam	Wide, Circle + Circle Floam pack insert	32.5	85.0	55.0	65.0	202.0
Sample C	Floam	Rectangular, Foam Top	38.5	82.9	52.0	64.5	202.5
Sample C + H	Floam	Rectangular, Foam Top + Rectangular Wrap	25.5	68.1	59.5	87.5	201.5
Sample D	Floam	Rectangular	31.5	77.5	47.5	61.5	167.5
Sample D + H	Floam	Rectangular + Rectangular Wrap	29.0	80.4	58.3	72.7	200.3

It is believed that by having one compartment of suitable composite mixture, the mixture can move in all directions when a load is applied. The material continues to redisperse until the optimal pressure distribution has been achieved. The mixture moves out of high pressure areas and collects in the lower pressure areas. As this continues, the pressure in the lower areas rises until the pressure gradient is abolished. This approximates the ideal strap design since this ability to redistribute allows the bladder to better conform to the load bearing surface. Compartmentalized designs, be it in the form of "bubbles" or pockets or strips, obviously can not perform this redistribution function laterally and hence they are inferior in terms of contouring. Reduced contouring translates into reduced contact area for pressure/load distribution. This means higher pressures and more discomfort due to more insult to the biological tissues.

In addition it is believed that compartmentalization actually reduces the area of contact to several points. The single bladder of a preferred embodiment of this invention has potentially the full surface area of the bladder for contact, while the bubble pack would only have the surface area underneath each bubble for contact. This means that even if the bubble pack had perfect contouring, such as on a flat surface, there would be less potential area for contact than the current invention. Therefore, less area means increased pressures and discomfort and injury to the tissues.

The tables also illustrate that the addition of foam padding to the top of a bladder insert (Sample A,C) on a strap or the use of foam padding(Sample 1,2) on a strap is not as effective as the bladder insert alone (Samples B, D) on a strap which had average maximum pressures of: 186 mmHg (Sample A); 202.5 mmHg (Sample C); 233.5 mmHg (Sample 1); 205.5 mmHg (Sample 2); 170 mmHg (Sample B); and 167.5 (Sample D).

It is believed that the foam member was actually confining the fluid inside the bladder from redistributing freely in Samples A and C. When the strap is placed over the shoulder, conformity to the shoulder area is of prime importance along with minimalisation of any head pressure back exerted upon the appropriate anatomy. To achieve this, the fluid within the bladder must be as free as possible to move within the bladder walls upon perturbation by the appropriate anatomy. The foam member acts as a non-flexible wall which restricts the fluid moving upward and out of the way of the impinging shoulder. This would translate into higher pressures, hence there would be points of very high pressures generated. The data gathered supports the above theory and it is clear that the addition of this foam member over the bladder, had a significant detrimental impact on the pressure distribution of the composite mixture of Floam™ in the bladder.

In addition, the tables illustrate comparisons which were made with preferred embodiments of the current invention and with a wrap of padding around such preferred embodiments. The data shows that the wrap around straps had significantly worse

performances in terms of pressures generated. Consistently, they achieved higher pressure readings.

It is believed that because the single bladder design requires that the fluid not be under tension so that it has the ability to move freely and to redistribute in order to reach an optimal equilibrium. When a wrap type product is put on, sufficient force must be used to ensure the wrap stays on the strap. This force creates more resting tension on the fluid filled bladder which makes it more difficult for the fluid to redistribute appropriately and hence reduces conformation. Less conformation translates into reduced surface area and therefore, pressures rise and discomfort increases.

Tables 2 and 3, which ranked the straps tested by maximum peak pressures and which averaged the maximum peak pressures to demonstrate several points. First, a shoulder strap containing a composite mixture of the invention did predominately better then a standard foam strap. For example, if the rectangular embodiment of a shoulder strap of the present invention (167.5 mmHg average maximum pressure) is compared to the standard foam rectangular strap (245 mmHg average maximum pressure), there is a clear reduction in maximum pressures. The standard foam shoulder strap has approximately 46% higher peak pressures. This implies that regardless of strap design, the composite mixture in the shoulder straps of the present invention reduces peak pressures.

With the enormous reduction in pressures, there will be less injury to the skin and muscles. The function of the muscles will be less impaired due to the reduced direct and indirect insults. This could potentially translate into more consistent swings for the avid golfer.

The shoulder straps of the present invention have been shown to reduce peak pressures when compared to standard foam straps.

Referring to Figure 9 and 10, a second embodiment of the present invention is illustrated. The shoulder strap 110 has a main strap 114. The main strap 114 has an area intermediate the ends thereof which has flaps 122 and 124. The area generally corresponds to the area where a user would contact the shoulder strap 110 when a load such as a golf bag is being carried. The flaps 122 and 124 have a width approximately equal to the width of the strap 114.

The inside surface of flap 122 has a strip 126 of either a hook portion or a loop portion of a hook and loop fastener. The outside surface of flap 124 has a strip 128 of the complementary portion of the hook and loop fastener. In addition, the strap 114 has strips 125 and 127 at either end of the area on which the bladder is placed on the strap 114. The strips 125 and 127 are a hook or loop portion of a hook and loop fastener with the inside surface of flap 124 having complementary strips 129 and 131 of the hook and loop fastener. As flap 124 is folded over the strap 114 the portion of the hook and loop fasteners 129 and 131 on flap 122 are attached/fastened to strips 125 and 127 so that the

ends of flap 122 are attached to the strap 114. Flap 122 is then folded over flap 124 so that the hook and loop fastener representing strips 126 and 128 is closed such that the flaps 122 and 124 together with the strap define a pocket therein. Bladder 130 and foam pad 132 is retained within the pocket.

It is now apparent to a person skilled in the art that numerous combinations and variations of shoulder straps may be manufactured using the present invention. However, since many other modifications and purposes of this invention become readily apparent to those skilled in the art upon perusal of the foregoing description, it is to be understood that certain changes in style, amounts and components may be effective without a departure from the spirit of the invention and within the scope of the appended claims.

In particular, the shoulder strap of the present invention can be used to carry any suitable object, including, but not limited to: golf bags; other sports bags (including hockey, tennis, gym, etc.); luggage; briefcases; school bags; computer bags; backpacks and totes.

We claim:

1. A shoulder strap for a bag , said strap having a bladder of a composite mixture for distributing a tensile load applied to ends of said strap, said tensile load transferred through said bladder over a contact area between said strap and said shoulder.

2. A shoulder strap as claimed in claim 1 wherein said bladder is enveloped within said strap at said contact area.

3. A shoulder strap as claimed in claim 1 wherein said strap has a pocket for receiving said bladder.

4. A shoulder strap as claimed in claim 3 wherein said pocket has a fastener for releasably opening and closing said pocket for selectively removing and replacing said bladder.

5. A shoulder strap as claimed in claim 3 wherein said pocket is sewn to an inner layer of said strap.

6. A shoulder strap as claimed in claim 1 wherein said composite mixture comprises a liquid with a viscosity of greater than 900 centipoise.

7. A shoulder strap as claimed in claim 1 wherein said composite mixture comprises a molecular dispersion with a viscosity of greater than 900 centipoise.

8. A shoulder strap as claimed in claim 7 wherein said composite mixture further comprises a colloidal dispersion.

9. A shoulder strap as claimed in claim 1 wherein said composite mixture comprises a colloidal dispersion selected from one or more of the following mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid; macromolecules/solvent; or micelles/solvent.

10. A shoulder strap as claimed in claim 9 wherein said composite mixture further comprises a molecular dispersion.

11. A shoulder strap as claimed in claim 1 wherein said composite mixture comprises a coarse dispersion.

12. A shoulder strap as claimed in claim 11 wherein said composite mixture further comprises one or more of the following mixtures: a molecular dispersion; a colloidal dispersion selected from one or more of the following mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid; macromolecules/solvent; or micelles/solvent; or a molecular and a colloidal dispersion wherein the colloidal dispersion is selected from one or more of the following mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid; macromolecules/solvent; or micelles/solvent.

13. A shoulder strap as claimed in claim 1 wherein said composite mixture comprises Floam™.

14. A shoulder strap as claimed in claim 1 wherein said composite mixture is a composition comprising micro-spheres.

15. A shoulder strap as claimed in claim 1 wherein said bladder is flexible and substantially inelastic.

16. A shoulder strap for a bag comprising:

a pad having a pocket and a bladder comprising a composite mixture retained in said pocket, and

a first strap and a second strap attached at opposite ends of said pad.

17. A shoulder strap as claimed in claim 16 wherein said pocket has a fastener for releasably opening and closing said pocket for selectively removing and replacing said bladder.

18. A shoulder strap as claimed in claim 16 wherein said pocket is sewn to an inner surface of said strap.

19. A shoulder strap as claimed in claim 16 wherein said composite mixture is a liquid having a viscosity greater than 900 centipoise.

20. A shoulder strap as claimed in claim 16 wherein said composite mixture is a coarse dispersion.

21. A shoulder strap as claimed in claim 16 wherein said composite mixture further comprises one or more of the following mixtures: a molecular dispersion; a colloidal dispersion selected from one or more of the following mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid; macromolecules/solvent; or micelles/solvent; or a molecular and a colloidal dispersion wherein the colloidal dispersion is selected from one or more of the following mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; gas/liquid; macromolecules/solvent; or micelles/solvent.

22. A shoulder strap as claimed in claim 16 wherein said composite mixture comprises a molecular dispersion having a viscosity greater than 900 centipoise.

23. A shoulder strap as claimed in claim 16 wherein said composite mixture comprises a colloidal dispersion selected from one or more of the following mixtures of dispersion phase/dispersion medium: liquid/liquid; solid/liquid; or gas/liquid; macromolecules/solvent; or micelles/solvent.

24. A shoulder strap as claimed in claim 16 wherein said bladder is flexible and substantially inelastic.

25. A shoulder strap for a bag comprising:

a pad having means for constraining acomposite mixture therein,

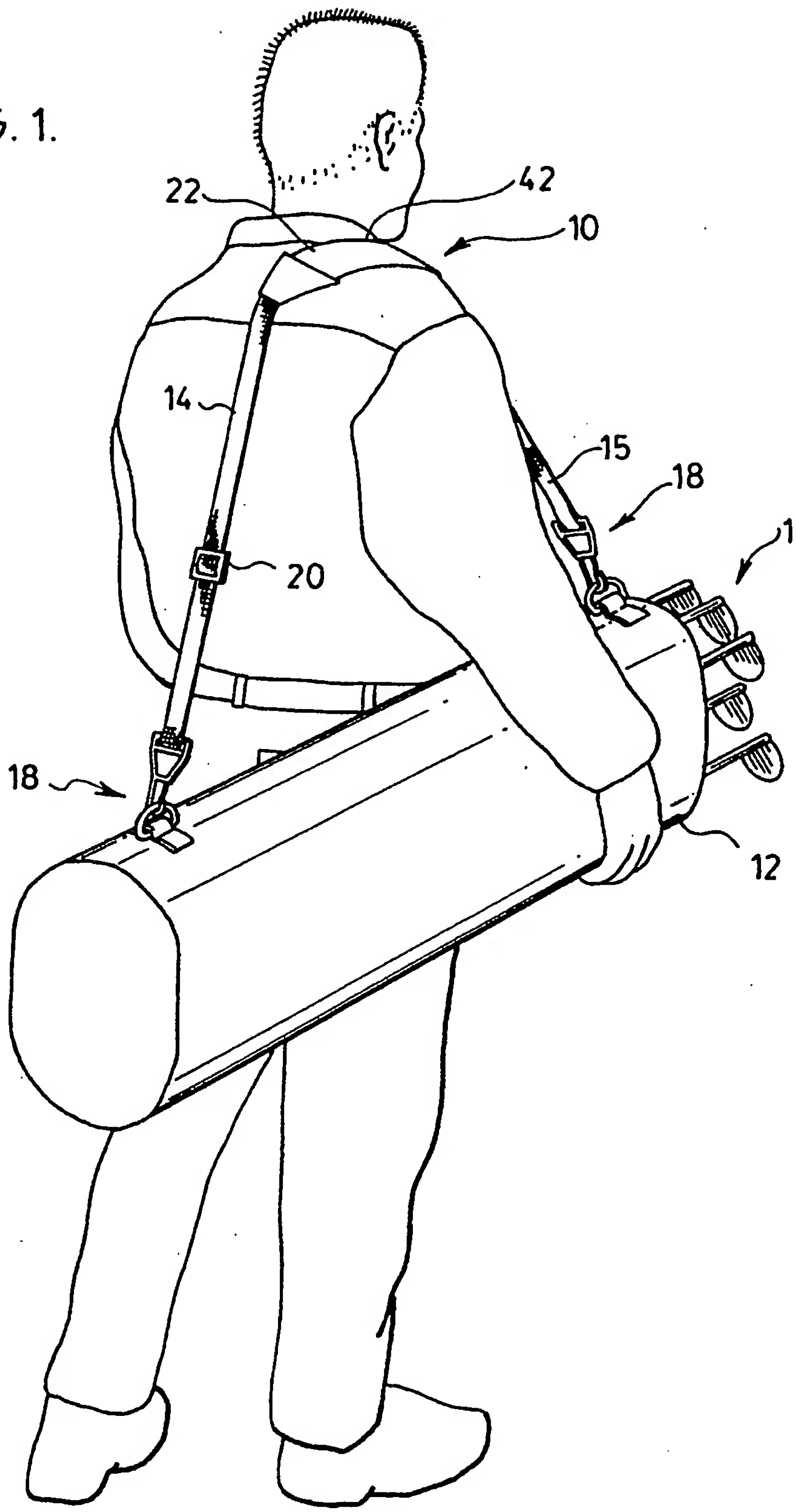
a first strap and a second strap attached at opposite ends of said pad, and

a volume of said composite mixture within said means, said volume sufficient for transferring tensile loads applied to opposite ends of said first and second straps through said means to distribute said loads substantially evenly over a contact area between said shoulder strap and a shoulder of human anatomy.

26. A shoulder strap as claimed in claim 25, wherein said constraining means is flexible and substantially inelastic.

27. A shoulder strap for a bag wherein the shoulder strap is placed over a person's shoulder to carry said bag and wherein said shoulder strap has a pad having a pocket and a bladder wherein said bladder comprises a composite mixture in a volume sufficient for transferring tensile loads across substantially the entire area in which the pad contacts the shoulder and said composite mixture comprises Floam™.

FIG. 1.



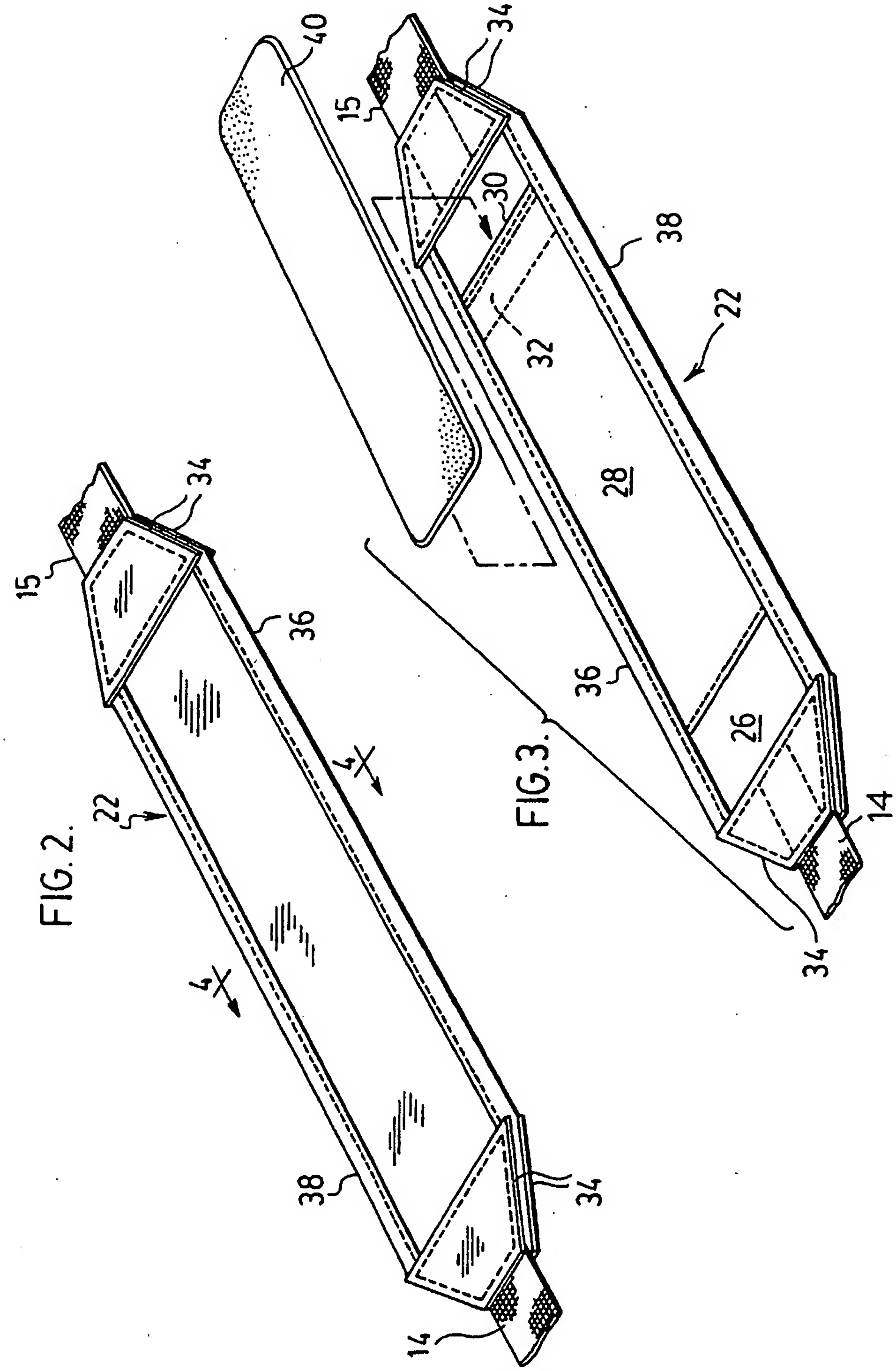


FIG. 2.

FIG. 3.

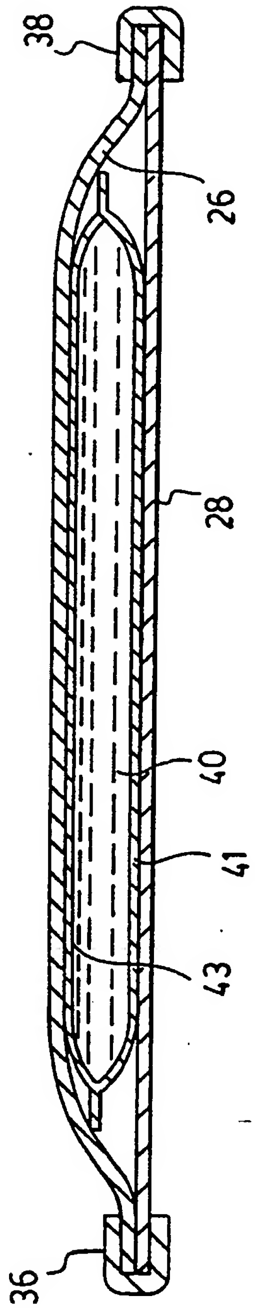


FIG. 4.

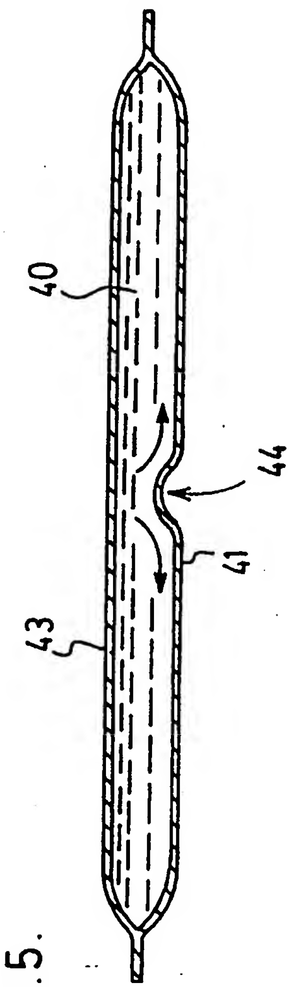
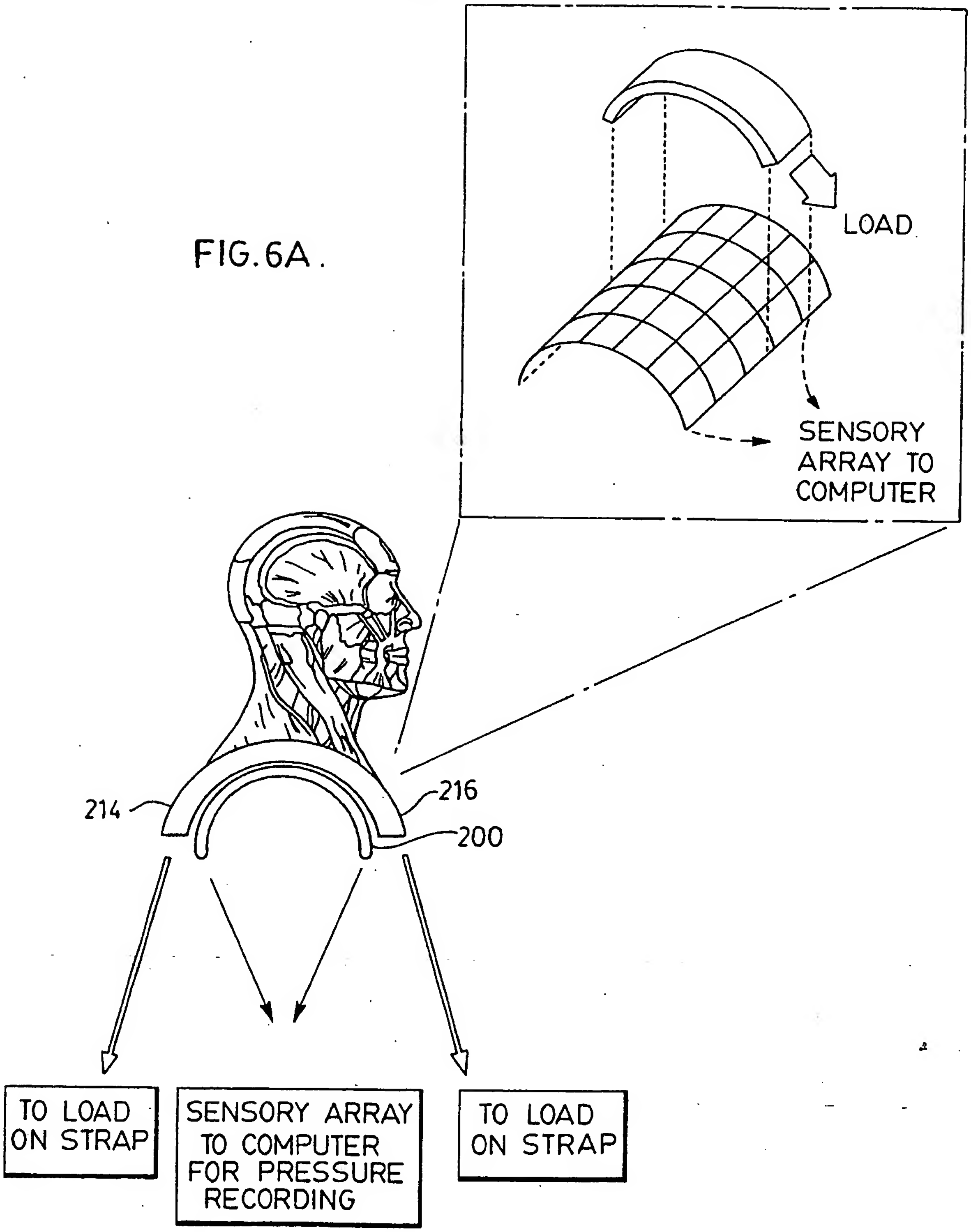


FIG. 5.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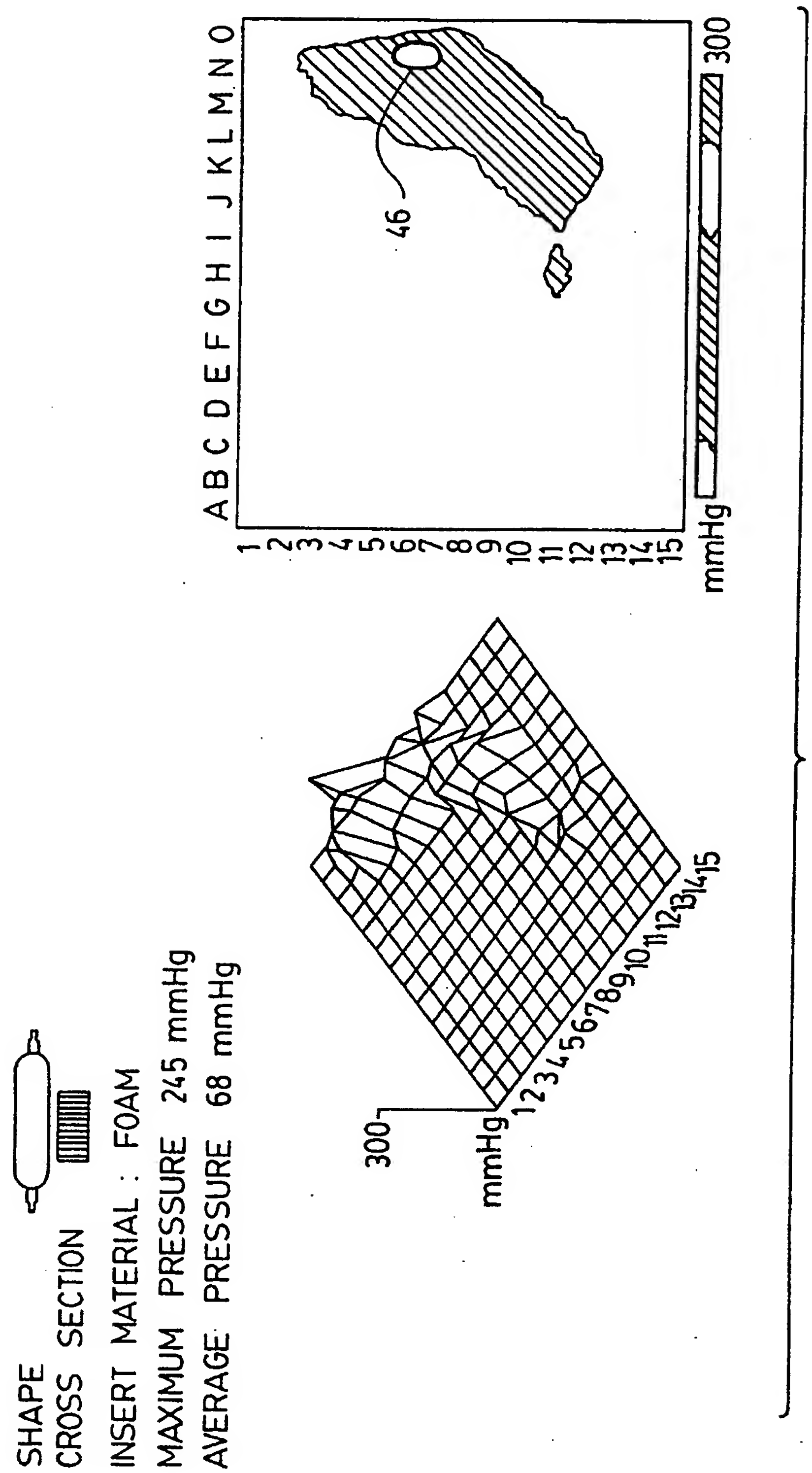
SENSORY
ARRAY TO
COMPUTER
214
216
200
TO LOAD
ON STRAP
SENSORY ARRAY
TO COMPUTER
FOR PRESSURE
RECORDING
TO LOAD
ON STRAP

FIG.6A.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AVERAGE PRESSURE 68 mmHg
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mmHg
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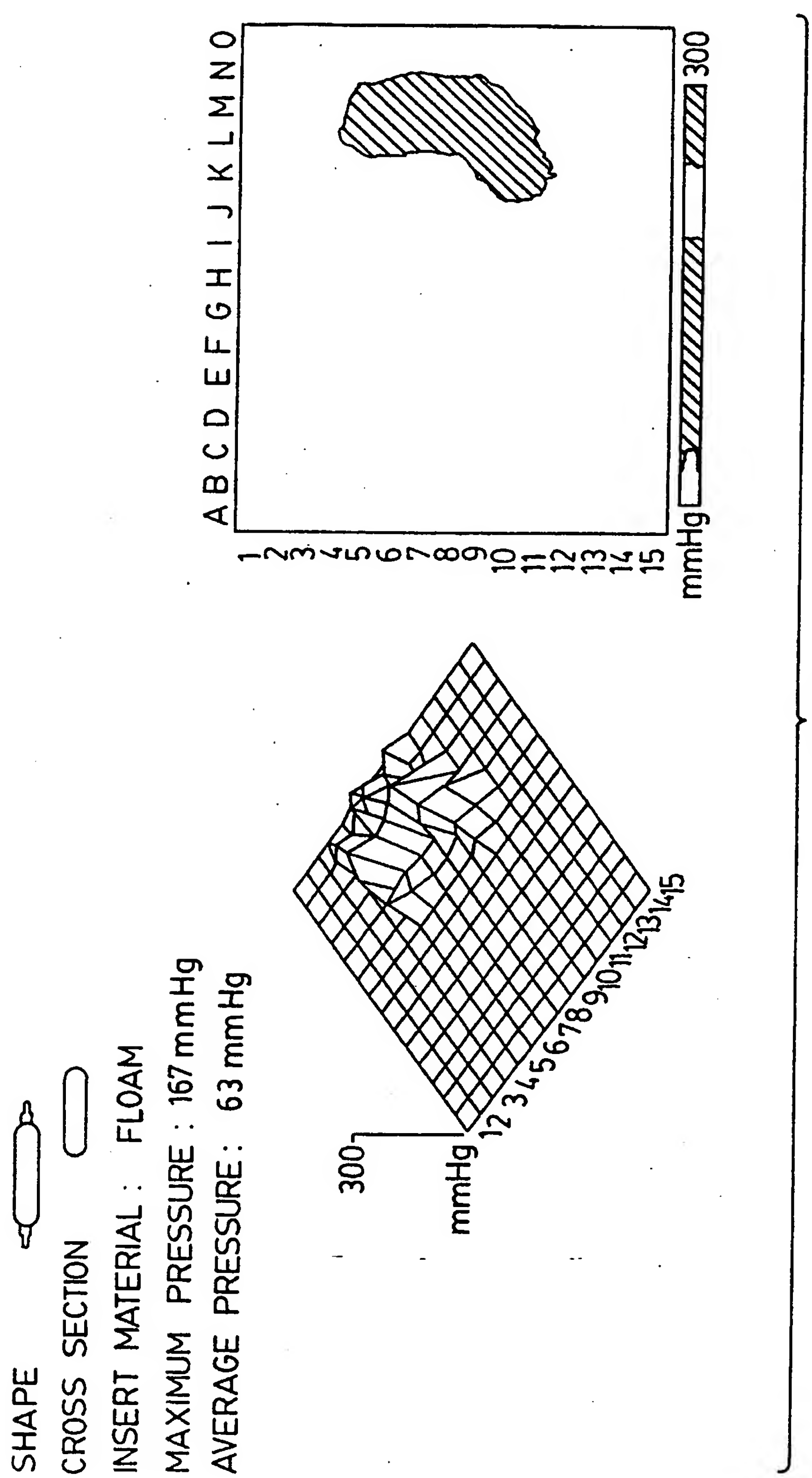
A B C D E F G H I J K L M N O
46
mmHg
300

FIG.6B.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MAXIMUM PRESSURE : 167 mmHg
AVERAGE PRESSURE : 63 mmHg
300
mmHg
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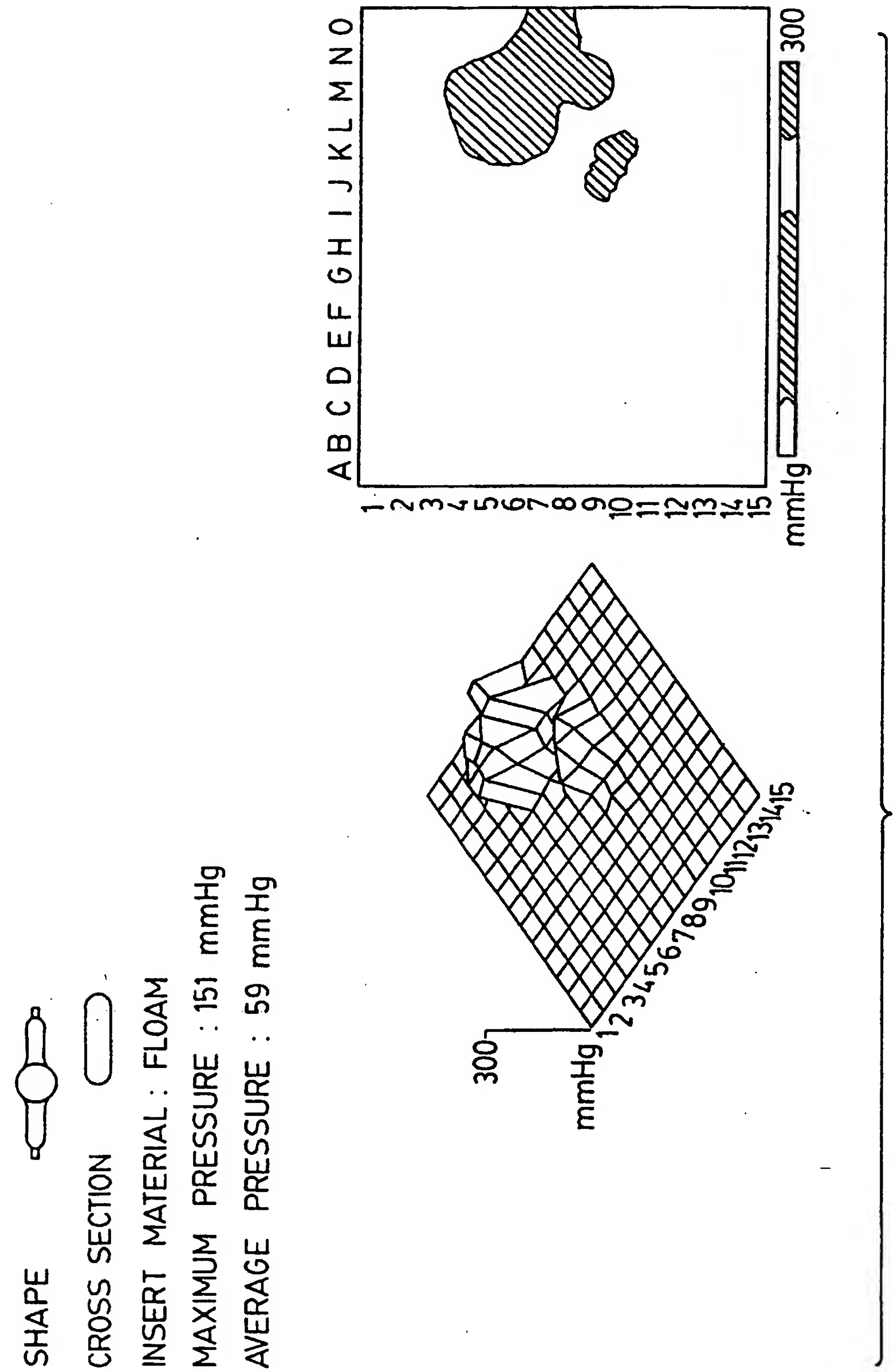
mmHg
300

FIG.7.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mmHg
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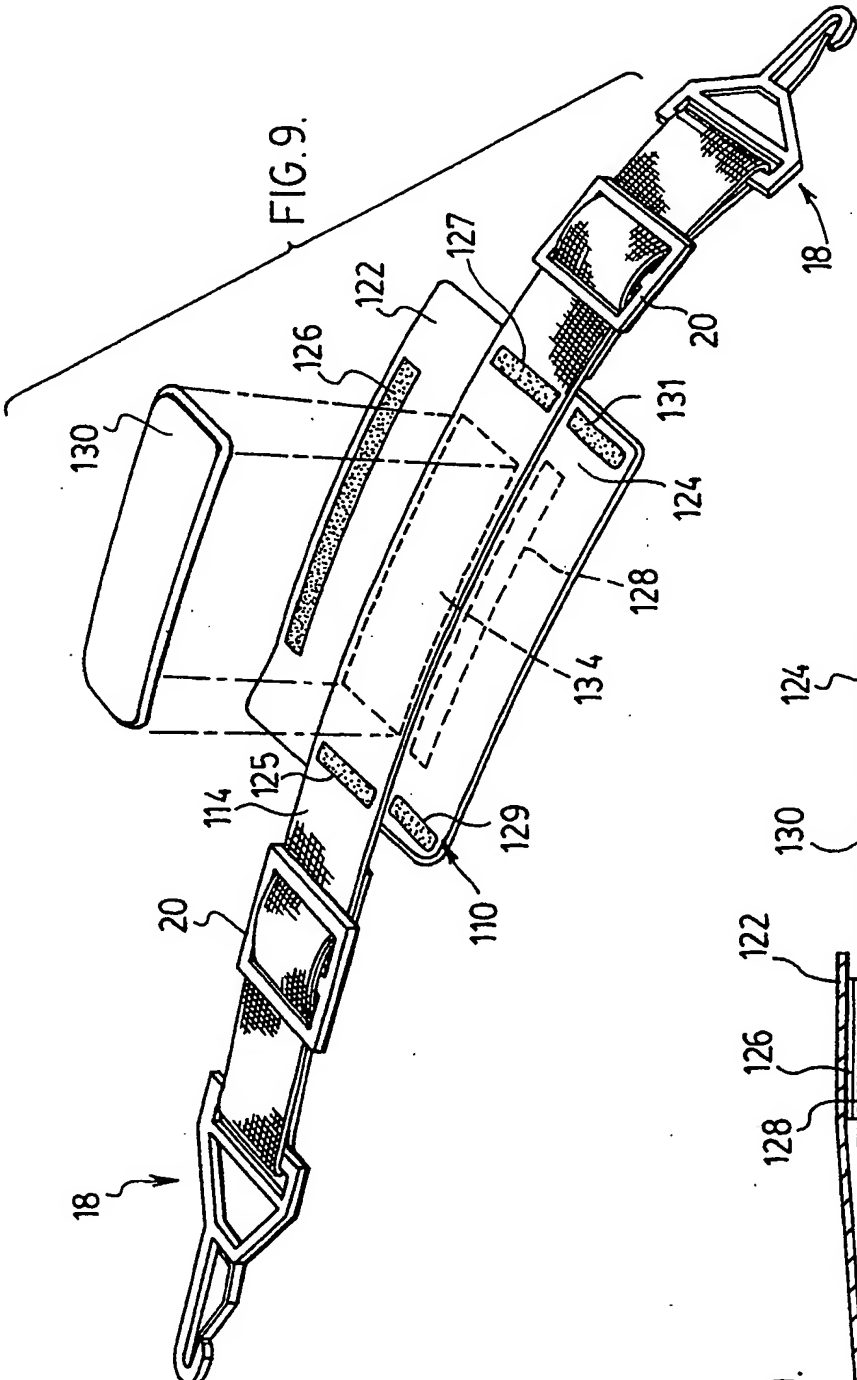
mmHg
300

FIG.8.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18

FIG.9.

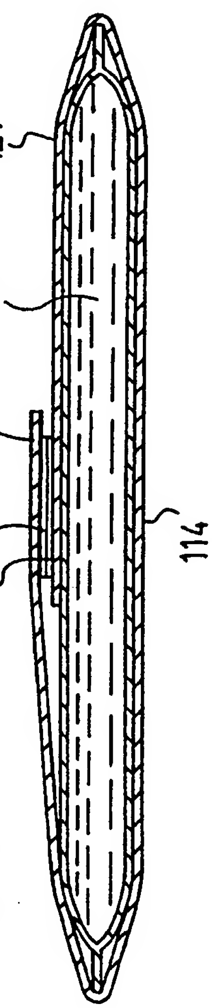
124
130
122
126
128
114

FIG.10.

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/CA 97/00789

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A45F3/12 A63B55/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A45F A63B A45C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 85 03623 A (SÖRDAL) 29 August 1985	1,2,16, 25
A	see the whole document	6,19,27
A	EP 0 551 733 A (MODAN INDUSTRIES) 21 July 1993 see column 7, line 55 - column 8, line 24; figures 19-21	1,16,25, 27
A	US 5 445 858 A (NWOKO) 29 August 1995 see the whole document	1,16,25, 27
A	US 5 549 743 A (PEARCE) 27 August 1996 cited in the application see the whole document	1,13-15, 27

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
6 March 1998	16/03/1998
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Sigwalt, C

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 421 874 A (PEARCE) 6 June 1995 see the whole document ---	1,13-15, 27
A	DE 43 44 694 A (HOFFMANN) 14 September 1995 see the whole document ---	1-4
A	FR 2 697 143 A (SOCIÉTÉ NOUVELLE MILLET) 29 April 1994 see page 4, line 16 - line 31; figures 3,4 ---	2,3
A	FR 2 406 402 A (LEXINGTON PRODUCTS) 18 May 1979 ---	
A	GB 219 874 A (MARKS) 7 August 1924 ---	
A	DE 92 01 628 U (CONZET HJALMAR) 9 April 1992 ---	
A	US 4 456 642 A (BURGDÖRFER) 26 June 1984 -----	

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte   .onal Application No
PCT/CA 97/00789

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 8503623 A	29-08-85	US 4662087 A	05-05-87
		AU 3934485 A	10-09-85
		EP 0172199 A	26-02-86
EP 0551733 A	21-07-93	IL 100374 A	07-10-94
		IL 102800 A	28-11-94
		IL 102903 A	08-12-95
		JP 6197810 A	19-07-94
		US 5577648 A	26-11-96
US 5445858 A	29-08-95	NONE	
US 5549743 A	27-08-96	US 5421874 A	06-06-95
		AU 5967096 A	24-12-96
		WO 9639065 A	12-12-96
		US 5626657 A	06-05-97
US 5421874 A	06-06-95	US 5549743 A	27-08-96
		US 5626657 A	06-05-97
DE 4344694 A	14-09-95	NONE	
FR 2697143 A	29-04-94	WO 9409672 A	11-05-94
FR 2406402 A	18-05-79	NONE	
GB 219874 A		NONE	
DE 9201628 U	09-04-92	NONE	
US 4456642 A	26-06-84	DE 3103564 A	26-08-82
		AU 556892 B	27-11-86
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		DK 45582 A	04-08-82
		EP 0057838 A	18-08-82
		JP 1637236 C	31-01-92
		JP 3002190 B	14-01-91
		JP 57159847 A	02-10-82